BOOK REVIEW: *FLIGHT STRATEGIES OF MIGRATING HAWKS*

by Paul M. Roberts

Flight Strategies of Migrating Hawks by Paul Kerlinger. 1989. Chicago: University of Chicago Press. 375 pages. $19.95 paperback.

A Broad-winged Hawk and a Peregrine Falcon are about to be released in Maine. Both are migrating to South America. You must bet the ranch on which bird will cross the Rio Grande first. You would put it all on the Peregrine, right? Not if you had read this book.

How many miles can hawks fly in one day? How fast do they fly? How high? How far away can you see them? How do they know where to go? How do they orient themselves? If you have ever asked yourself one of these questions, the likelihood is that you could not find a good answer. Until now.

Flight Strategies of Migrating Hawks not only provides answers to these questions; it provides much, much more than the seemingly arcane title implies. *Flight Strategies* is only the second significant monograph on hawk migration in North America. Donald Heintzelman's groundbreaking *Autumn Hawk Flights*, published in 1975, was the first. Heintzelman documented what was then known about North American hawk migration in terms of the calendar of migration, migration routes, and the means of migration. He also wrote extensively about hawkwatch sites, where most of his data were obtained. Paul Kerlinger, who is director of the Cape May Bird Observatory and director of research for the New Jersey Audubon Society, focuses on what is known about flight behavior.

Flight Strategies of Migrating Hawks works on two levels. On one level it is the most intellectually ambitious and challenging monograph ever published on hawk migration. On this level it is global in scope and application. On a second level it is a quantitative natural history of North American hawk migration, laden with valuable data that previously could be found only in obscure sources inaccessible to the average birder.

Kerlinger indicates in his preface that he cannot achieve the objective implicit in his title. He later explains that we do not have adequate empirical data to construct valid theories on flight strategy. However, he documents what is known and sets the agenda for research in the 1990s.

The book is divided into thirteen chapters. The first chapter, "Ecology and Geography of Hawk Migration," concludes that of 285 falconiforms worldwide, 53.4 percent are nonmigratory, 8.4 percent are irruptives, 31.9 percent are partial migrants, and only 6.3 percent are complete migrants (i.e., where ninety percent or more of the individuals leave the breeding range during the nonbreeding season). It then surveys what is known about differential migration by population, age, and gender. It is quickly clear how incredibly little we know about hawks period, much less their migration and flight strategies.

The second chapter, "Methods of Studying Migrating Hawks," is probably the most controversial. Reviewing the two most common methods of studying hawk migration, hawkwatch counts and banding, Kerlinger concludes that both are of *little* scientific value in analyzing hawk behavior (italics mine). This has earned him some anticipated brickbats, but it should not discourage people from reading this book or counting migrants. Kerlinger also provides a thorough review of other techniques, including radar, that can be used to study migration.

The third chapter looks at the natural selection of flight strategies, while the fourth chapter is a classic primer on the structure of the atmosphere that should be read by everyone interested in bird migration.

The remaining chapters examine major aspects of flight behavior: flight mechanics; flight direction (the roles of wind, topography, and geography); altitude of flight and visibility of migrants; flocking behavior; water crossing behavior; flight speed; and daily flight distance. Each chapter opens with a discussion of theory on the topic and then examines the empirical data. Much of the data Kerlinger cites are from his own graduate and postgraduate field research, which often involved some of the best-known authorities on bird migration, such as Ken Able and S.A. Gauthreaux. Massachusetts birders are fortunate in that most of this research involved our common migrants, such as the Broad-winged Hawk and Sharp-shinned Hawk.

Kerlinger's data challenge hawkwatching's conventional wisdom time and again. For example, many hawkwatchers believe that falcons spend most of their migratory time in powered flight. Kerlinger shows that virtually all hawks, including falcons, spend most of their migration in gliding flight (which by his definition includes soaring), not in powered flight. He also examines the widely accepted theory of wind drift, which assumes that migrant hawks can be driven off course, or drifted, by strong winds. This theory is used to explain high counts at some locations and the wide variation in totals at hawkwatch sites from year to year. Kerlinger concludes that wind drift is minimal at best and irrelevant to hawk migration counts.

Kerlinger shows that, contrary to popular opinion, east and southeast winds are much more favorable to migrating hawks using thermals in the fall than are west winds (Wachusett Mountain in Princeton, Massachusetts, has reported some significant flights on southeast winds). Citing studies conducted by the New England Hawk Watch (now the NorthEast Hawk Watch), he also shows that migrant hawks in New England have generally been seen at altitudes between fifteen hundred and three thousand feet above ground level, which is much lower than many hawkwatchers thought was the case. (However, research elsewhere shows hawks soaring to more than six thousand feet above ground level.)

The visibility of migrants is critical to hawk counts. One study coauthored by Kerlinger found that few North American hawks were difficult to see with

the naked eye when flying directly overhead at an altitude less than 950 feet above ground level. However, against a cloudless sky, Sharpshins and kestrels became difficult to see with the naked eye when only thirteen to sixteen hundred feet directly overhead. Broad-winged Hawks became very difficult to see with 7x binoculars when they were directly overhead at only thirty-five hundred feet. Flocks of several hundred Broadwings were difficult to see when directly overhead at sixty-four hundred feet. In fact, birds at that altitude could easily pass unnoticed. These data may surprise many hawkwatchers who believe their powers of observation are far greater than what Kerlinger describes here.

Kerlinger also examines the "noon lull" theory, only here he lands firmly on the side of orthodoxy. Many sites have reported fewer hawks during midday. Citing radar studies that show that most hawks achieve maximum altitude between the hours of 11:00 A.M. and 1:00 P.M., Kerlinger concludes that hawks relying on thermal lift may indeed be flying beyond the limits of human vision during the seeming "noon lulls." (Wachusett observers might question why they do not seem to experience noon lulls.)

Hawkwatchers often question how quickly birds are moving. Kerlinger's limited research on selected North American species shows that the average ground speed for hawks using orographic lift varies from twenty-four to thirty-five miles per hour, depending on the species. Hawks gliding out of thermals, however, can achieve air speeds averaging from forty-two to forty-nine miles per hour. Ground speeds may be somewhat higher, depending on weather conditions.

Kerlinger shows that most hawks should be able to average around 100 miles a day over a thirty-day migration period. He speculates that Broadwings should be able to fly as far as 250 miles in up to ten hours a day. However, several much more powerful radio-tagged Peregrine Falcons averaged only 115 miles per day, achieving a maximum of 206 miles in a single day. (This does not include the Greenland Peregrine, but shows why you should perhaps bet on the Broadwing to reach Mexico before the Peregrine.)

Regrettably, Kerlinger concludes that the professional research establishment is not likely to pursue study of hawk migration strategies because of academic fashion and the economics of raptor research. Nevertheless, he plots a road map for those who want to add to our knowledge of hawk migration, passing the torch to amateur hawkwatchers. On a crowded day on Wachusett, who is timing how long an individual bird remains in a thermal, in a glide between thermals, or in view? Who at Bolton Flats is counting the number of birds and species in individual kettles? Who on Mount Watatic is recording how the birds use the ridge versus the mountain? Who in West Newbury is recording the flight attitude of hawks coming out of thermals? Who is reporting full crops? Hawks feeding in flight? Age? Sex? Kerlinger shows how hawkwatching can be much more than counting, and how amateurs can make

significant contributions to our understanding of hawk migration.

In his criticism of the scientific value of hawk migration counts, Kerlinger challenges the large and growing body of amateurs to think more deeply about what they are doing, why they are doing it, and how they can make their investment of time and effort even more meaningful for understanding and protecting these incredible birds.

Wherever you hawkwatch, this book will immeasurably enhance your hawkwatching experience. This book also provides new insights for those whose interests are limited to the more general subject of bird migration.

My criticisms of this book are few. When Kerlinger is critical of the scientific value of hawk migration counts, he appears to be using a very narrow definition of the word "scientific." I cannot disagree with anything he says about the limitations of hawk counts, but his discussion is incomplete and therefore misleading. The book is also fraught with statistics that could deter a casual reader. This book is directed to a technically astute audience, e.g., professional biologists. Do not let this dissuade you: most of his data and discussions and all his conclusions are in clear, succinct English.

Do not purchase this book for its impressive color photographs; there are none. There are a modest number of functional black-and-white photographs and line drawings, and numerous charts and graphs.

The good news is that this book is a classic that any hawkwatcher must read and will refer to time and again. The bad news is that there is every reason to believe it may be decades before we see the next significant monograph on hawk migration.

PAUL M. ROBERTS of Medford has been an active hawkwatcher for almost twenty years. Paul founded the Eastern Massachusetts Hawk Watch in 1976, and at various times led that organization as well as the New England Hawk Watch and the Hawk Migration Association of North America. He lectures and gives introductory courses on hawk migration and identification to diverse audiences throughout New England. Paul would like the readers of this review to know that he contributed some very minor data for this book and that he reviewed portions of the text in manuscript form for Dr. Kerlinger. Neither involvement materially influenced this review.